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10/551,598	09/30/2005	Mark W Wanlass	NREL-01-52	1452
Paul J. White Nrel 1617 Cole Blvd. Golden, CO 80401				
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MOWLA, GOLAM				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/551,598

**Applicant(s)**

WANLASS ET AL.

**Examiner**

GOLAM MOWLA

**Art Unit**

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 January 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-77 is/are pending in the application.
- 4a) Of the above claim(s) 10,36-38,41,46-48 and 50-77 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9,11-35,39,40,42-45 and 49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 December 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsman's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 09/30/2005
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election with traverse of Group I, Species A and sub-species A<sub>1</sub> in the reply filed on 01/05/2010 is acknowledged. The traversal is on the ground(s) that each of the claims in groups I-V share a special technical feature that is not disclosed in U.S. Patent No. 5,912,068 to Jia, because each claim shares a compliant substrate comprising a base layer of silicon having a layer of perovskite oxide positioned thereon and a layer of silicon oxide interposed there between, the silicon oxide layer providing interracial stress relief to the underlying perovskite oxide layer, allowing the compliant substrate to accommodate growth of semiconductor materials having a lattice constant from about 5.4 angstroms to about 5.9 angstroms.

This is not found persuasive because Jia explicitly teaches a base layer of silicon (leftmost Si layer of the solar cell device having overall structure Si/SiO<sub>2</sub>/YSZ/Si) (3:65-4:2) having a layer of perovskite oxide positioned thereon (Jia at 3:32-38 teaches the use of perovskite layer comprising instant claimed SrTiO<sub>3</sub> or BaTiO<sub>3</sub>) and a layer of silicon oxide interposed there between (3:65-4:2). Since Jia teaches the compliant substrate is made of same material as the instant invention, the silicon oxide layer providing interracial stress relief to the underlying perovskite oxide layer and the compliant substrate must inherently accommodate the growth of semiconductor materials having a lattice constant from about 5.4Å to about 5.9Å.

The requirement is still deemed proper and is therefore made FINAL.

2. Although Applicant stated that claims 1-9, 11-40, and 42-49 of Group I read on these elected species and sub-species (see page 4 of Applicant's response submitted on 01/05/2010), claims 36-38 and 46-48 are directed to non-elected species B (as it requires Ge-Based compound). Hence, claims 10, 36-38, 41, 46-48 and 50-77 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected Invention/species/sub-species, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 05/01/2010.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1 and 3-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jia (US 5,912,068) in view of King et al. (US 6,340,788 B1), and further in view of Olson et al. (US 6,281,426 B1).

Regarding claim 1 and 3-6, Jia teaches A photovoltaic cell (solar cell) (3:65-4:2) for converting radiant energy into electrical current and voltage, the electrical current created by charge carrier movement, the photovoltaic cell comprising: a compliant substrate comprising a base layer of silicon (leftmost Si layer of the solar cell device having overall structure Si/SiO<sub>2</sub>/YSZ/Si) (3:65-4:2) having a layer of perovskite oxide positioned thereon (Jia at 3:32-38 teaches the use of perovskite layer comprising instant claimed SrTiO<sub>3</sub> or BaTiO<sub>3</sub>) and a layer of silicon oxide interposed there between (3:65-4:2). Since Jia teaches the compliant substrate is made of same material as the instant invention, the silicon oxide layer providing interracial stress relief to the underlying perovskite oxide layer and the compliant substrate must inherently accommodate the growth of semiconductor materials having a lattice constant from about 5.4Å to about 5.9Å.

Jia further teaches that the solar cell comprises a Si layer (rightmost layer). Although Jia teaches that the solar cell comprises Si layer, the reference is silent as to whether it is a subcell monolithically stacked on the compliant substrate (Si/SiO<sub>2</sub>/YSZ), the first subcell having a junction of at least one p-type layer of semiconductor material in face-to-face contact with at least one n-type layer of semiconductor material, the first subcell having a lattice constant accommodated by the compliant substrate, and wherein the first subcell has a predetermined first band-gap energy.

King discloses a photovoltaic cell (10) wherein Si active subcell (see figures 1-5) is being utilized in instead of single layer Si substrate such that it provides photogenerated current and density (fig. 1a and 5:64-6:3)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the Si subcell of King in the photovoltaic cell of Jia such that it photogenerated current and density. The subcell by definition has a junction of at least one p-type layer of semiconductor material in face-to-face contact with at least one n-type layer of semiconductor material (see also 6:10-25 of King).

Jia in view King does not explicitly show terminals attached to the photovoltaic cell to conduct current from and into the photovoltaic cell.

However, it is well known in the solar/photovoltaic art to use terminals (60 and 62) (see fig. 1 of Olson) attached to the photovoltaic cell (10) in order to facilitate the flow of photocurrent (6:26-31).

Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized terminals of Olson to attach to the photovoltaic cell of Jia in view of King in order to facilitate the flow of photocurrent, as taught by Olson.

Regarding claims 7-9, King further discloses that first subcell can as well be made of material such as GaAs or GaInAsP (6:10-25).

6. Claims 1-9, 11-35, 39-40, 42-45 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lewis (US 4,881,979) in view of Jia (US 5,912,068) in view of King et al. (US 6,340,788 B1), and further in view of Olson et al. (US 6,281,426 B1).

Regarding claim 1-6, 11-16 and 23-25, Lewis discloses photovoltaic cell (solar cell) (fig. 4) (12: 31-13:5) for converting radiant energy into electrical current and voltage, the electrical current created by charge carrier movement, the photovoltaic cell comprising: a substrate (100), a first subcell (104+106) and a second subcell (114+116). Lewis further teaches that the first subcell (104+106) having a junction of at least one p-type layer of semiconductor material (104) in face-to-face contact with at least one n-type layer of semiconductor material (106), the first subcell (104+106) having a lattice constant accommodated by the substrate, and wherein the first subcell has a predetermined first band-gap energy (12:45-49). Lewis also teaches a first PCC layer (102) , a second PCC layer (108), a first interconnection layer (110) between first (104+106) and second (114+116) subcells, and an isolation layer (112) between the second PCC layer (108) and the second subcell (114+116). Lewis also teaches that the second subcell has higher band gap than first subcell (9:22-24).

However, the reference is silent as to whether the substrate is an instant claimed compliant substrate.

Jia teaches a compliant substrate comprising a base layer of silicon (leftmost Si layer of the solar cell device having overall structure Si/SiO<sub>2</sub>/YSZ/Si) (3:65-4:2) having a layer of perovskite oxide positioned thereon (Jia at 3:32-38 teaches the use of perovskite layer comprising instant claimed SrTiO<sub>3</sub> or BaTiO<sub>3</sub>) and a layer of silicon oxide interposed there between (3:65-4:2). Since Jia teaches the compliant substrate is made of same material as the instant invention, the silicon oxide layer providing interracial stress relief to the underlying perovskite oxide layer and the compliant

substrate must inherently accommodate the growth of semiconductor materials having a lattice constant from about 5.4Å to about 5.9Å.

Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to have utilized the compliant substrate of Jia in the solar cell of Lewis as such use of the compliant substrate as the base layer of a solar cell is suggested by Jia (4:1-2).

Jia in view King does not explicitly show terminals attached to the photovoltaic cell to conduct current from and into the photovoltaic cell.

However, it is well known in the solar/photovoltaic art to use terminals (60 and 62) (see fig. 1 of Olson) attached to the photovoltaic cell (10) in order to facilitate the flow of photocurrent (6:26-31).

Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized terminals of Olson to attach to the photovoltaic cell of Jia in view of King in order to facilitate the flow of photocurrent, as taught by Olson.

Regarding claims 7-9, 17-22 and 26-31, Lewis further discloses that subcells can as well be made of material such as GaAs, GaAsP, GaInP, AlGaInP or AlGaInAs (13:2-5).

Regarding claims 32-35 and 42-45, Lewis further teaches that the top subcell has higher band gap than lower subcell (9:22-24). However, the reference is silent as to formation of third and fourth subcell, successively, on the second subcell, including the PCC layers and the interconnection layers between each subcell. It would have been obvious to one of ordinary skill in the art to add successive subcells with higher



bandgaps (as desired by Lewis, 9:22-24) on the second subcell such that more light can be harvested into electricity.

Regarding claims 39-40 and 49, Lewis further discloses that subcells can as well be made of material such as GaAs, GaAsP, GaInP, AlGaInP or AlGaInAs (13:2-5).

***Correspondence/Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-Th, 0800-1830 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ALEXA NECKEL can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/G. M./  
Examiner, Art Unit 1795

/Alexa D. Neckel/  
Supervisory Patent Examiner, Art Unit 1795